rising high edge of signal RCK transfers data from shift register **120** into IC3 and IC4, selecting or deselecting corresponding PDs, depending on the bit values at corresponding positions within the bit string. Thus, a first high RCK signal selects a first PD based on data in shift register **120**, followed by an SCK cycle shifting the data in shift register **120**, followed by a second RCK signal that deselects the first PD and selects a second PD based on the shifted data. Thus at time t3, PD06 is selected, and at time t4, PD06 is deselected and PD07 is selected.

**[0111]** As described above for the matrix of LED drivers shown in FIG. **11**, a similar matrix of PD receivers may be used in embodiments of the present invention. In this regard, reference is now made to FIG. **16**, which is a diagram of a photodiode matrix **500** for a touch screen, in accordance with an embodiment of the present invention. Matrix **500** as shown in FIG. **16** includes a 4×4 array of PDs. In general, matrix **500** may include an array of m×n PDs. Matrix **500** requires only m+n IO connectors. In distinction, prior art systems require two IO connectors per PD to scan a plurality of PDs, and thus matrix **500** represents a savings of 2 mn−m−n connectors. Each PD in matrix **500** is accessed by selecting an appropriate row connector and an appropriate column connector, corresponding to the row and column of the PD.

**[0112]** Shown in FIG. **16** are four 1-to-2 analog switches **510**, and four push-pull drivers **520**. Analog switches **510** are used to select a row, and push-pull drivers **520** are used to select a column. For each analog switch **510**, one terminal connects to GND and the other terminal connects to receiver electronics **530**, including an amplifier **540** and an ADC **550**. Opening one of analog switches **510** to receiver electronics **530** and putting the remaining switches to GND serves to select an active receiver row. Driving one of push-pull connectors **520** low and driving the remaining connectors to high serves to select an active column. For matrix **500** shown in FIG. **13**, the second from top analog switch is open and the second from left push-pull connector is low. The PD corresponding to the active row and column is shown circled in matrix **500**.

**[0113]** It will be appreciated by those skilled in the art that the row and column coordinates of the PDs are not related to the physical placement of the PDs on touch screen **100**. The row and column coordinates are only used for controlled selection of the PDs.

**[0114]** In accordance with an embodiment of the present invention, each PD receiver includes a photodiode **560** and a blocking diode **570**. Blocking diodes **570** are used to prevent disturbances between neighboring diodes **560**. According to an embodiment of the present invention, blocking diodes **570** are low backwards current and low backwards capacitance type diodes.

**[0115]** Further according to an embodiment of the present invention, the voltage +V at push-pull drivers **520** is greater than or equal to the voltage +Vref at receiver electronics **530**. A slightly higher voltage +V at push-pull drivers **520** than +Vref improves performance, since all blocking diodes **570** are in reversed state, except for the blocking diode of the PD receiver corresponding to the active row and column.

**[0116]** vi. PD Receivers **140**

**[0117]** In accordance with embodiments of the present invention, multiple configurations are described herein for PD receivers used with touch screen **100**. In each configuration, the PD output is sent to an analog-to-digital converter (ADC). The ADC matches the expected output range, and the output range differs from one configuration to another. The accuracy of touch screen **100** depends to a large extent on the accuracy of the ADC.

**[0118]** The PD receiver configuration is determined by three parameters: (1) the number of PD signals that enter controller **150**, (2) the type of integrator circuit used to bias and sample PD current as it enters controller **150**, and (3) the type of signal filter and amplifier circuit used, if any.

**[0119]** Regarding (1) the number of PD signals that enter controller **150**, in a first PD receiver configuration, the PDs along each edge of touch screen **100** have separate outputs. Thus, at least one circuit is provided for PDs that are arranged along one edge of touch screen **100**, and at least one other circuit is provided for PDs arranged along the other edge. In this regard, reference is made back to FIG. **5**, which shows all PD outputs along one edge channeled into signal PDROW, and all PD outputs along a second edge channeled into signal PDCOL. A capacitor and a biasing resistor are coupled to each of the ADC input signals to control the current and to set a voltage amplitude range.

**[0120]** In a second PD receiver configuration, a limited number of PDs are connected to each ADC input. PDs may be grouped, for example, into sections of up to four PDs per section. Each output thus integrates four PDs. An advantage of this second configuration is less capacitance and less disturbance from non-selected neighboring PDs.

**[0121]** In order to further reduce capacitance and disturbance from non-selected neighboring PDs, an embodiment of the present invention adds at least one multiplexer that outputs only the selected PD signal. In this regard reference is now made to FIG. **17**, which is a diagram of multiplexer **171**, which operates as a PD output selector, in accordance with an embodiment of the present invention. FIG. **17** shows two parallel multiplexers **171**, which each receives eight PD signals as input, and generates a single output signal. As described hereinabove with reference to FIG. **6**, the PD output is processed by signal filters and amplifiers **175**. For a touch screen with 64 PDs, in a configuration using eight multiplexers **171**, each multiplexer taking eight PD input signals and outputting to a signal filter and amplifier **175**, eight such filters and amplifier **175** are used.

**[0122]** The dotted line shown in FIG. **17** separates components internal to controller **150**, which are shown to the right of the dotted line, from components external to controller **150**, which appear to the left of the dotted line. Controller **150** includes a multiplexer **151**, which connects to an analog to digital converter **152**. The signals entering multiplexers **171** from the top are control signals from controller **150**. Each such control signal uses three bits, to control selection of one of the eight input PDs. In general, n control bits suffice for controlling selection of up to $2^n$ input PDs.

**[0123]** In addition to the three control bits used to control selection of the input PDs, each multiplexer **171** receives an output enable control bit, OE_NOT, from controller **150**. When OE_NOT is set to zero, the PD driver outputs the selected PD signal. When OE_NOT is set to one, the PD driver outputs a high impedance signal.

**[0124]** TABLE I summarizes the logical input-output relationships used with each PD multiplexer **171**.